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GENERAL CONSIDERATIONS ON THE PATHOLOGY OF THE SERIOUS FORMS OF CHRONIC OSTEOMYELITIS AND THEIR COMPLICATIONS.

Being the Inaugural Lecture to the Course on
Surgical Pathology, Delivered October 16,
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By CHARLES GREENE CUMSTON, B.M.S., M.D.

Assistant Professor of Surgical Pathology in the Faculty of Medicine, Tufts
College, Boston, Mass.

GENTLEMEN:—It is with much pleasure that I begin today my fourth year as incumbent to the chair of Surgical Pathology in this Faculty, and I can assure you that all my efforts will be used to make these lectures as interesting and as instructive as possible.

As in the former years, it is my intention to devote the first lecture to the study of some question of surgical pathology worthy of your careful consideration, and for the present occasion I have selected the subject of the serious forms of chronic osteomyelitis and their complications, because it is one of great practical interest, and to which little attention has been paid on this side of the Atlantic.

A focus of osteomyelitis in one or several bones is the most frequent lesion found in the chronic form of this affection and may be the cause of much serious illness and suffering to the patient, and exacting a high degree of skill on the part of the surgeon to bring the case to a happy outcome.

The localizations of this affection are more particularly to be found in the long bones, especially at the lower end of the femur and upper end of the tibia, while in the upper limb we find the upper extremity of the humerus and the lower end of the radius and ulna. The statements made by Ollier regarding the

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seat of acute osteomyelitis apply to the chronic forms when frequency is considered. The chronic forms may also occur in the flat bones, just as the acute type does. The bones of the cranium and the short bones may also be the seat of the chronic types of osteomyelitis, but this is infrequent.

Osteomyelitis may occur in two ways. Sometimes the attacks take place in a focus that was primarily the site of an acute process, and little by little will increase the extent of the trouble. Sometimes they manifest themselves in a bone in the neighborhood or at a distance from the primary focus. There are lesions, such as hyperostosis, necrosis and abscess of the bones, which belong to the less severe types of the disease, but usually on account of their extent, their persistency and the considerable impotency that they produce, the chronic form is rendered very serious on account of the bad general condition into which the patient is thrown.

Besides these lesions there are others, such as spontaneous fracture, disproportional elongation of both bones in a segment of a limb, as, for example, the leg or the forearm, which are more peculiar to chronic osteomyelitis, and which I shall consider later on in this lecture.

Usually the clinical symptoms will be thus put before the surgeon. A patient is cured of his acute osteomyelitis, and then, considering himself well, goes about his usual occupation. After a variable time, perhaps one, or even several years, under the influence of traumatism or an infectious disease, or even without any apparent cause, the patient usually feels a pain, which is localized in a limb. These pains are in the first place dull, and are easily borne by the patient, and he may even be able to walk and attend to his work. But, after being intermittent, they little by little become continuous and often take on the character of an acute affection, such as they had when the patient was first taken with the acute manifestations, and, when this occurs, they will present very severe exacerbations.

These attacks of pain may occur at any time during the day, but the principal time for their appear-

ance is in the night. This nocturnal recrudescence has been mentioned by a large number of writers. The patient cannot sleep, or, if he does doze off for an instant, he is instantly wakened by a new attack. The privation of sleep is one of the most frequent consequences, and at the same time one of the most troublesome of this form of chronic osteomyelitis; consequently this is often the first symptom of which the patient speaks when questioned. He will also tell you that the pain is increased by walking, standing up or when pressure is exercised over the parts.

These pains have been compared by patients to a sharp point of fire in the center of the diseased spot, or to hammer-blows directed on the bone. Others will tell you that the pain is deep with a feeling of tearing, while still others will describe it as lancing and penetrating. These pains at first sight offer a certain resemblance to the osteoscopic pains met with in syphilis.

As the disease becomes of long standing, the intensity, frequency and duration of the attacks of pain also increase, the suffering becomes excessive in spite of the treatments applied, and several times it has happened that these unfortunate patients have come to the surgeon, begging him to amputate their limb, in order to deliver them from the torture which they had been undergoing for the last few years. In pursuance of these symptoms complained of by the patient, after having carefully questioned him on his antecedents, and after having examined his bone, you will usually find either hyperostosis, necrosis or an abscess of the bone, but these three lesions may be all combined in the same individual, at the seat of recurrence of an osteomyelitis.

Considering now hyperostosis, I would say that it is situated in the juxtaepiphyseal region, and, although this is its usual seat, it may be complete and surround the diaphysis in its entire length, but usually it is partial and decreases from the epiphysis to the diaphysis. Instead of extending around the entire circumference of the bone, to which it gives a globular form, it may only be localized on a point of the latter.

Generally an hyperostosis of the bones is irregular, its surface may be smooth, but in most cases it presents furrows and cavities of various sizes, giving it a variable aspect, to such an extent that in certain cases of general hyperostosis, some of the bones look like old dry tree-trunks, which have been eaten away by insects, and which are only held up by their bark.

Now if you trephin or perforate with a bone curet one of these worm-eaten bones, you will be astonished that in certain places the bone-tissue will present an unusual degree of hardness, and it will be with the greatest difficulty that it can be cut through with the gouge; it appears to have lost part of its substance, and you will find combined in one bone both processes of osteitis, namely rarefying osteitis and the compact osteitis.

It may happen that these hyperostoses will conceal an abscess of the bone or a necrosis. This is extremely frequent in the tibia. The bone is exteriorly deformed. It appears increased in size, but its interior presents irregular cavities in the bone, out of which you will be able to scrape small sequestrums and a certain amount of pus. This pathologic condition explains why spontaneous fractures so often occur during a chronic osteomyelitis.

Abscess of the bone may only show itself a long time after the first attack of osteomyelitis and indicates a wakening up of the former affection, whose infectious agent has not become completely destroyed. Under some influences this agent takes on its former virulence; at other times the abscess is the direct consequence of the acute affection. That is to say that the patient, who has suffered a great deal during an acute osteomyelitis, and fearing another surgical operation, prefers to see a little pus continue to come away from the primary focus, and he considers himself fortunate to have already escaped from death; but this abscess will continue, suppuration weakens the patient, who finally is obliged to consult the surgeon.

These abscesses present several important symptoms. The first is an increase in size of the diseased part, which usually is noticeable at about the same time that the pains make their appearance. In the

beginning its increase in size is rather more appreciable to touch than to sight and it becomes more and more pronounced as the disease advances. The extent of the tumefaction is not generally of any great amount, and according to Broca it rarely is more than one-third of the total length of the bone. The swelling is generally regular and gives the bone a fusiform look which appears as if blown out. Above and below, the tumefaction insensibly spreads way into the soft parts. The surface of the swelling is usually uniform, because in abscess of the bone, their size is quite considerable, and the pus is to be found under the skin and sooner or later will make its way outwards.

A character which has been absolutely demonstrated is a local elevation of the temperature, even when no inflammatory complication is present. In order to detect this symptom you must make a comparative examination of both limbs and have exposed them first to the air for a few minutes, in such a manner as to have placed them in an equilibrium with the temperature of the air of the room.

The skin may present different aspects, according to the length of time that the lesion has been present, as well as to the extent of the underlying abscess. Sometimes it is smooth, elastic and moves easily over the underlying tissues; at other times there may be seen a depression, and the skin will be found adherent to the periosteum over the cicatrix of a former abscess which had opened. When you are dealing with an abscess which has been present for several months, it is infrequent to find the skin presenting a normal color, and it will be usually a more or less dark red or violet hue. Quite frequently an area of variable color is present, sometimes of an intense red, while at others pale, which is quite circumscribed. These spots have a certain important clinical value because they give us a very precise indication as to the point of the bone over which we should trephine, in order to reach the abscess. The integuments sometimes present a particular bronze color over the swelling, which is due to an increase in the pigmentary secretions of the skin, and it may occupy the entire extent, or only certain parts of the tumefaction.

The soft parts covering the bones may also be attacked by the abscess. The latter may have two starting points. The first are abscesses by neighborhood, taking start in an extension of the general inflammation of the periosteum and continuing to the cellular tissue which surrounds it. These subperiosteal abscesses occur in variable numbers during the course of the disease. Although generally very limited, they are accompanied by the usual symptoms met with in abscess of the soft parts. They open exteriorly and after having given issue to pus for a certain time, they finally end by healing up. They have one characteristic, which is this: When a sound is introduced by the orifice of the fistula, which persists after they have broken open, you will never be able to reach down on a denuded body surface; the surface of the bone being always covered by a thick periosteum.

Generally speaking, the abscesses which form come from the bones and are accompanied by fistulas. These fistulas have a peculiar appearance which will always allow the surgeon to distinguish them from a fistula due to a tuberculosis of the bone. They are depressed, adherent with hard borders which present fungous growths and are undermined. By exercising pressure over the integuments in the neighborhood, you will not be able to express any caseous matter nor the white soft fungous masses such as those found in cold abscesses.

When the opening of these fistulas is sufficiently large, a thing which is infrequent, it is possible to introduce the sound into the cavity. If you can execute this maneuver, it will be seen that the instrument runs a very variable course; the walls of the fistulous track are receding and not friable, as in caries, and the cavity does not contain any trace of sequestrum. In some cases these interosseous fistulas are so narrow and so winding in their course that the finest silver probe cannot be made to enter them, and besides they do not always open exteriorly. It frequently happens that abscesses of the soft parts become cicatrized, and the integuments temporarily cover the orifice of the fistulas, up to the time when

the pus which has accumulated in the cavity again breaks outwards. This alternating closing and opening of the fistula may take place quite a number of times during the course of the affection. Spontaneous opening of a painful abscess of the bone exteriorly is generally followed by a temporary decrease in the pain, but it should not be considered as a step towards recovery. It is necessary that the opening be sufficiently large to give free issue to the pus, and, if it is inoculated on serum, a growth of streptococci, which are usually the cause of osteomyelitis, will soon be seen.

We now come to the consideration of necrosis. Necrosis is present when the bone tissues are dead. In this case the necrosed tissues or sequestrum play the part of septic foreign bodies in the parts in which they exist, and by their presence keep up suppuration. A sequestrum may be found in any or all parts of a bone, either in the region of the epiphysis or in the juxtaepiphyseal region, or in the diaphysis. They may be superficial or deep. Their color is usually yellow, and, if they are carefully examined you may often detect a large number of small, fine drops of pus. Sometimes a diseased bone will contain only one sequestrum; at others there may be several. The sequestrum is completely separated from the living tissues, or else it may adhere by some small point. It may be free, or, which is most usual, bound up by new bone, in which case the latter is riddled by cloacae. There may thus exist between the sequestrum and the layer of new bone a sufficiently large space to allow the former to be somewhat movable. The extent of a sequestrum is very variable; usually they do not measure more than 4 centimeters in length and 5 or 6 millimeters in thickness.

When a sequestrum is situated in the juxtaepiphyseal region of a bone, it may irritate the conjugate cartilages, perforating them and entering into the joint, as is often observed. Besides these lesions of chronic osteomyelitis, there are others far more curious, which consist in various deformities, resulting from troubles taking place in the growth and consist-

ency of the diseased bone, and I will in the first place speak of the arrest and excess of growth.

An arrest in the growth is due to a lesion in the juxtaepiphyseal region, and is the more marked the younger the patient is, as well as the more severe the inflammation. It is seen at its height when the inflammation has invaded the bone entirely, or is situated at the same time in both its ends. When this occurs, it is known as bipolar osteitis. The shortening of a bone of a limb which is the seat of chronic osteomyelitis is sometimes very considerable, when the same bone of the opposite side is compared with it.

Gangolphe, in his recent work on "The Infectious Diseases of the Bones," gives the photograph of a patient who was the subject of an infectious acute osteomyelitis of the lower end of the right femur, at the age of 7. When she entered his service, the patient was 18 years old, and up to that time had only walked with crutches. The diseased femur was shortened to the enormous extent of about 9 centimeters; and what was more, this lower end was singularly changed in its proportions. The internal condyle which was more projecting extended very much lower than the external and pushed the corresponding articular surface of the tibia in such a way that it gave the general look of a genu valgum.

Instead of having an arrest in growth, there may be on the contrary an excess. The lengthening of the bone is the cause of a difference in size of the corresponding limbs, and consequently brings about limping. We can take as a type the tibia, especially so on account of the frequency of its lesions. At the end of a few months or a year the diseased tibia may grow 2, 3 or 4 centimeters, and often more than the healthy tibia. According to Gangolphe, osteomyelitis, when situated about the middle of the bone, is more apt to produce this excess in growth, while, when the disease attacks the ends, an arrest in development occurs.

These modifications in the length of the bone produce functional troubles in the limbs. In the first place we find a deformity; the normal curves are ex-

aggerated, or, on the contrary, are less marked under the influence of too hasty walking. In a limb in which there are but two bones, as, for example, in the forearm and the leg, one of them may not follow the other in its increase in size, and the result is that the longest bone is obliged to curve more or less at the middle, in order to articulate with the extremities of the other. This curve is all the more pronounced the larger be the increase in length of the one bone in relation to the other.

This disproportion in the length of two bones of one limb will produce a deviation of the hand or of the foot. When situated in the leg, when the tibia presents an arrest in growth due to a lesion situated in one or both its ends, the foot becomes inclined inwards, and the patient places it on the ground on its external border, and thus it becomes a pes varus. If, on the contrary, the fibula is the seat of disease, you will then find a pes valgus. Now turning to the upper limb, if the radius is arrested in its growth, the hand will be directed upwards on the radial border of the forearm. If, on the contrary, the ulna is diseased, the hand will be directed inwardly.

On account of the decrease in the resistance of the bone, a detachment of the epiphysis, or even a real fracture may occur. This last unfortunate occurrence is sometimes of only short duration, because there may be a subperiosteal bony layer secreted in considerable abundance, which will act as a splint to the detached diaphysis. But this is not always the case, and generally speaking these kinds of fractures constitute a complication which increases the chance of septicemia or purulent infection and often necessitates a very severe surgical operation.

These spontaneous fractures may occur either in the juxtaepiphyseal region or in the diaphysis, and the symptoms are not the same in each case. Detachment of the epiphysis produces separation of the diaphysis from the epiphysis, and occurs very rapidly, following necrosis of the neighboring zone of spongy tissue, which is near the cartilage of connection. It is in the enlarged part of the diaphysis, the bulb of the bone, in which this fracture usually oc-

curs, and generally is brought about by an extremely slight traumatism, such as muscular contraction or a displacement of the limb. These fractures may occur very early in the disease. The bony surfaces which are separated, or sometimes only adherent by a few points, are usually irregular. The fracture is not oblique, but is zigzag. The necrosis sometimes only attacks the end of the diaphysis, while at others it attacks the diaphysis itself. These fractures may become consolidated, if they are taken care of early, and if the focus at which the detachment of the diaphysis has taken place, is disinfected.

Fractures occurring in the body of the bone take place at variable times, but usually they occur a long period after the beginning of the disease. They may be situated towards the upper third or the lower third of the long bones, the middle being less frequently the seat. The femur is the bone which is most frequently fractured, and this takes place at a more or less great distance from the knee. The upper and the middle third may also be the seat of fracture. The tibia, ribs, and exceptionally the humerus, may also be the seat of fracture. Necrosis is the most essential cause of these lesions, but it acts more or less directly in bringing about the solution of continuity. Spontaneous fractures may take place under two circumstances during the course of a chronic osteomyelitis. The bone is laid bare; the loss of substance is too considerable, and, consequently, on account of its slight resistance, the bone breaks. In the other case you have a bone going through the process of repair, and there is a layer of bone surrounding the necrosed part, but it is not sufficiently solid, and the patient when using his limb will feel the bone give way at this weak point. These fractures are oftentimes a danger in that they may set at liberty a sequestrum, which has been invaginated, and which in its turn, on account of its shape, may either cause a laceration of an artery and thus bring about a dangerous hemorrhage, or irritate a neighboring nerve, thus producing a paralysis.

We have now considered the bone localizations and complications of chronic osteomyelitis, and I

will now take up the joint troubles which may be observed in this disease. After a variable length of time, chronic osteomyelitis may attack the joints and extension of the process may take place by various mechanisms. An abscess of the bone developed during an acute or chronic period, and when situated in the center of a hyperostosis, instead of burrowing towards the exterior and making its exit by a fistula, may push itself way through the spongy tissue of the epiphysis up under the diarthrodial cartilage, which it will slowly ulcerate and finally perforate. We then find in the cartilage the same loss of substance and these same depressions similar to those found in acute osteomyelitis. From this a secondary suppurating arthritis results. Sometimes the contamination of the joint may occur by the penetration of a sequestrum into its cavity; at other times we find the soft parts, and more particularly the synovial culs-de-sac, which have in time relations with the joints and the epiphyses, serving as conductors of the infection.

The arthrites that are observed during the progress of a chronic osteomyelitis may either be suppurating or not. When the nature of their liquid contents is serous, they are not usually grave in their consequence, but when pus is present, they are dangerous. The joints which are most frequently the seat of these complications, are in order of frequency, the knee, the coxo-femoral joint, the shoulder, and the elbow. These arthrites of chronic osteomyelitis offer a particular symptomatology, and they appear when they are first examined to be very similar to tuberculosis of the joints, and consequently it is most essential a correct diagnosis be made in order to avoid a mistake in treatment.

In these cases pain is the first functional symptom that the patient complains of; it follows the course that I have already mentioned in the beginning of this lecture; that is to say, it increases little by little in intensity and finally arrives at such a height as to render the joints impotent. It may be relieved momentarily by quiet and immobility, but it will surely recur as soon as the patient moves the limb.

The joint which, to all external appearances, has

been normal, soon begins to increase in size. This increase occurs progressively without producing a very marked deformity. After a fatigue or traumatism, or an infectious disease, which gives the chronic affection a start, so to speak, a slight acute attack will occur, and which disappears as soon as the patient remains quiet. Little by little the joint movements become less and less free, and they are all the more limited, because they produce so much pain; there finally comes a time when the pain, the functional impotency and distress force the patient to consult his physician, if he does not want to be continually quiet. The localization in the joint is at this time effected. Now, if you examine a joint, and let us take for example the knee, which is usually the one attacked, this is what is found. Usually the knee is normal, and by palpation the tumefaction appears to be situated in the periarticular tissues rather than in the joint itself. Prominences are easily felt by the examining finger, and sometimes, when the tumefaction is not very considerable, they may even be seen, a condition which never occurs in white swelling. There are certain points around the joint which are more painful than others. We will not be able to feel any fungosities, and the joint will usually appear enlarged, while in a white swelling the joint will appear increased in height on account of the inflammatory state of the synovial membrane as well as to the production of lardaceous tissue. The skin is usually normal, especially when the contents of the joint are a serous fluid. As in hydarthroses, the ligaments are very much relaxed, and abnormal lateral movements may be given to the joint to quite an extent. When, on the contrary, we are dealing with a suppurating arthritis, we will usually see in the neighborhood some purulent foci which communicate with the epiphyses, and in some places the skin is ulcerated and of a violet color.

At the end of an indeterminable time the periarticular tissues become changed in their anatomical makeup. The quadriceps becomes extremely thin, and its lower insertions lose their attachments on account of their contact with a purulent focus. The

action of the flexors of the leg outdoes that of the extensors; the lower limb is no longer in extension, but is half flexed with abduction and outward rotation. It thus results that in the first place we would be rather inclined to make a diagnosis of tubercular arthritis of the knee, on account of the general aspect of the limb, as well as the atrophy of the triceps and the swollen condition of the joint. Now, what will prevent us from making this error in diagnosis, is the fact that we learn from the patient that the lesion did not begin in the knee but was first noticed in the lower extremity of the femur or the upper extremity of the tibia and fibula, and that the patient also gives the history of a former acute osteomyelitis.

An arthritis of the hip, due to an osteomyelitis, sometimes presents certain characters that render the differential diagnosis with coxalgia a very difficult problem. The following case is of interest in this respect. The right lower limb of the patient presented an abnormal attitude, which at first sight certainly looked like a coxalgia. When the patient was on the bed, the limb appeared to be elongated, but by measurement it was found 3 centimeters shorter than the opposite one. The anterosuperior spine was lowered and carried forward. When these displacements were corrected, it was seen that the limb was in flexion with abduction and outward rotation. The palpation of the femur showed that the upper extremity of the diaphysis was noticeably hypertrophied and the greater trochanter was nearly trebled its normal size. There were two fistulas in the thigh where two abscesses had burrowed outwards. These fistulas were not fungous, and between them there was an extensive detachment. There was besides on the anterior aspect of the thigh, about at its middle third, a red depressible and slightly painful point. There was no thickening felt in the groin.

The patient was chloroformed and the fistulas were explored and showed that they led directly on the denuded greater trochanter. The probe entered into a cavity, which ended at the depressible red point on the anterior aspect of the thigh already mentioned. The tracks of the fistulas were opened up with the

thermocautery and drained. The first incision was vertical and was made behind and exteriorly to the greater trochanter and immediately led down on an absolutely movable sequestrum, which measured 5 centimeters in length and 2 in breadth. The borders of this sequestrum were irregular; its external aspect was compact, while the internal was porous and concave. After the sequestrum had been removed the greater trochanter was chiselled out with a gouge. At no point, either in the fistulas or in the cavity of the bone, could any membrane be found which could be compared to that of a tuberculous abscess.

Under these conditions it is easy to understand how a patient who has an arthritis of the lower limb, due to osteomyelitis, may be afflicted most terribly by pains and difficulty by movement or in walking. Occasionally, but only at the beginning of the disease, the patient may still do a little work, but he suffers in consequence. If you watch these patients walk, you will remark that they are careful to keep their limb in extension, and in avoiding to bear their weight upon it, they draw their leg after them; others will use crutches, and, as the foot is no longer placed upon the ground, a flexion of the knee will little by little take place under the influence of the muscles of the posterior aspect of the thigh, which are in a state of constant contraction; and lastly a time will come when these unfortunate patients are obliged to take their beds and there remain during a more or less considerable length of time, and it is when they arrive at this condition that the surgeon is called.

When once an operation has been performed it is really astonishing to see how quickly these apparently serious cases get well, and Tillaux has well demonstrated that the operative results in arthritis, due to osteomyelitis, are very much superior to those obtained in white swellings in general, and in particular tuberculosis of the knee, and that a large number of resections performed for a socalled tuberculous arthritis, which gave good results, are really only cases of osteoarthritis following a chronic osteomyelitis. Besides these characters of a pseudo-tuberculosis of the joint, the joint localizations of chronic osteomyeli-

tis also present other complications, such as dislocations and enthyloses, which I will now consider.

Of all the subdislocations, the most frequent is backward displacement of the tibia. This is rendered easy on account of the position of the limb, which is in a more or less considerable flexion; in this position the flexor muscles of the leg or the thigh are contracted, as I have already said and pull the tibia backwards; the latter slides backwards from the condyles of the femur, and little by little projects into the popliteal space, at which time one can distinctly feel the condyles of the femur, which project under the skin and cause a very appreciable projection, both to sight and to palpation. Dislocation of the patella is variable, but very often this bone becomes intimately adherent to one or the other of the condyles, and when this has occurred it is impossible to give any movements to it. Under these circumstances the patella will not move when the tibia or the femur become displaced.

Subdislocation, when it has once occurred, is kept up on account of muscular contraction. Under chloroform it may be quite easily reduced, because the narcosis causes the contraction of the muscles to disappear. Salmon justly remarks that this fact gives still another argument in favor of muscular contraction in the pathological phenomena of backward subdislocation of the tibia, and that when resection of the knee is performed and the limb once more rendered straight, the leg may little by little become again flexed on the thigh, if it is not firmly held in place by a posterior splint.

It is to these subdislocations that the phenomena known by the name of "*double knee*" is due, and it consists in the following condition: When the lower limb is slightly flexed, you will notice an upper projection, due to the flexion of the epiphysis on the diaphysis, which is caused by an interposition of a spongy tissue between the diaphysis and the cartilage of connection, in such a manner that one would at first sight think he was dealing with fracture of the patella with spreading of the fragments. The lower projection is formed by the patella and this deformity is increased by the predominating action of the flexor

muscles of the leg. An inverse deformity may also be noted. The flexure of the diaphysis on the epiphysis is produced in a contrary sense, and there then is seen an angle projecting backwards and instead of an anterior projection there is a depression over the line of connection. There is no ankylosis, but the movements are more limited than normal.

Another pathological process produced in joints by a chronic osteomyelitis, is an incomplete or absolute immobilization of the articular surface, and this ankylosis may be true or false. An ankylosis is a true one when the loss of movement is due to a change in the parts making up the joints,—namely, the bone, cartilage, ligaments and synovial membrane. It is a false one when impotency is produced by some disorder of the peripheral tissues, such as the muscles, tendons, cellular tissue or skin. True ankylosis results, as I have said, from a loss of the most important parts of the joint, but let me add that it is infrequent, and usually is incomplete. It is very difficult to diagnose from a false ankylosis, when first seen, and it is only by means of a complete narcosis that one can decide whether the ankylosis is due to a muscular contraction or not, which is very frequently the case. Under the influence of an anesthetic, which does away with the pain and the resistance of the muscles, one will be able to find out whether the surfaces of the joints slide over one another or not.

Another frequent cause of error must be also avoided. We might attribute supplementary movements of a healthy neighboring joint to an ankylosis of another joint, and, consequently, the articulation should be firmly grasped, and an endeavor to give it its natural movements must be made. Besides these ankyloses due to retraction or contraction of the muscles, there are others which are sometimes the result of a bad cicatrix or a sclerosis of the subcutaneous connective tissue. It is the case when there is absolute immobility, the adhesions may not be bony, but to fibrous bands which are very short and may oppose the slightest sliding of the bones. According to Malgaigne fibrous tissues may be diagnosed from

bony tissues in complete ankylosis, as follows : the tentatives of flexion or extension produce no pain in a joint, the seat of ankylosis by bony fusion, while on the other hand they produce much pain from the insertions of the fibrous bands when these exist.

An ankylosis may also occur when there is no inflammation of the joint, and is simply due to bone lesions which deform the joint and prevent the free play of the articular surfaces, which no longer slide with ease one over the other. Thus, often after a chronic osteomyelitis of the lower end of the femur, the knee remains nearly completely ankylosed by the simple presence of a consecutive hyperostosis, although the synovial membrane has undergone no inflammatory processes or, at any rate, no suppurating processes.

It is exactly the same when two bones unite together, such, for example, as in the forearm and the leg. The hyperostosis of one may be communicated to the other by the stalactites, which produce a true ankylosis about at the level of the interosseous ligament. Occasionally, union between both bones is only partial and limited ; at other times it is general, and it may be said that they are absolutely included in the newly formed bone-tissue.

It has been thought that in certain cases prolonged immobilization, especially when it takes place in a bad position of the joint, might be the cause of ankylosis. The hypothesis was emitted that the ligaments, which were relaxed in certain positions of the joint, became retracted if this position remained permanently. This may be correct, but in these cases it is difficult to eliminate inflammation, and it is usually the latter process which is the cause of the bad attitude of the limb, and it is also to inflammation that the changes in structure of the ligaments are due which produce their retraction.

In summing up, gentlemen, I would say that we must admit the action of these three factors in the production of these ankyloses, namely *a bad position of the limb, immobility, and inflammation*.

Chronic osteomyelitis does not only attack the bones and the joints, but it may extend to other parts

of the organism. I would divide these other manifestations into local and general. In the first we have troubles in the muscles, the nerves, the arteries and the veins in the neighborhood of the infectious focus ; while in the second group we have the pathologic changes which take place in the kidneys, heart, liver, etc. In the first place, gentlemen, let us consider the local complications.

On account of their intimate relationship with the bones and the joints, the muscles are attacked by the affection at a very early date, and the lesion which is most frequently met with, is atrophy. Various and different theories have been put forward to explain this condition. I would only mention that the theory of John Hunter, who thought that all these secondary troubles were due to sympathy, that is to say, that the muscles were conscious that the diseased parts could not reply to their action, and that it was one of the phenomena of the living organism which has the most resemblance to human reason. If the disease was only temporary, as in ordinary inflammation, the muscles would not become atrophied, because they were conscious that the parts would soon become well.

A more admissible theory is that of immobilization. Muscular atrophy, occurring during chronic osteomyelitis, results from a functional inactivity, as that which is produced during immobilization in fractures and diseases of the joints. Although this theory demonstrates one important fact, that of functional inactivity of the muscle, it is certainly insufficient to explain these rapid and often general amyotrophies, which occur during the chronic form of the disease under consideration. Broca believes that the muscle becomes atrophied, because it does not receive as much blood as before the disease began. This theory does not appear to be realized in the large majority of cases, and this pathogenic interpretation is certainly only rarely applicable. Other writers have considered the muscular lesion as subordinated to that of the joint ; as the latter is not always diseased, this theory is not always exact either. According to Duplay and Clado, the inflammation in

the joint extends to the muscles, a sclerosis occurs which little by little destroys all the muscular fibers, and after this course only a tense fibrous tissue with a few fat globules intermingled in it in place of the muscle is to be found ; the muscular fiber appears to undergo a fatty degeneration, which commences in the depth of the fiber.

As to the nervous element, in spite of repeated examinations, it has always given a negative result. Now, as all the preceding theories leave much to be desired, a certain number of writers have thought that muscular atrophy might be due to neuritis. According to Descosses, there is a compression caused by the inflamed tissues on the nervous endings of the joint, which, after a certain time, will produce an inflammation of the nerve ; the inflammation will little by little extend to the nervous plexus and produce an atrophy of the muscles, whose nerves are in a diseased condition. When certain muscles are supplied by a nerve, which is in very direct relation with the diseased joint, they are the ones usually attacked by atrophy ; such, for example, as the quadriceps for the knee-joint. There are trophic troubles similar to those produced by compression or a nervous lesion that may coexist, such as hyperesthesia in certain parts of the joint, analgesia, subcutaneous adiposis, functional troubles of the skin, which becomes scaly, dry and hard in certain points.

The theory of ascending neuritis, which is similar to the foregoing, has this advantage that it can explain, not only the lesions of the muscles in the neighborhood of the joints or the diseased bone, but the atrophy of the entire limb, and that of the healthy side as well, a condition of affairs that has been several times met with.

According to this hypothesis, the inflammation extends to the spinal marrow and by its intermediary homologous nerves of the healthy side, may produce an atrophy on the healthy side as well. Although such lesions may take place, and they have been demonstrated by the experiments of Hayem in the rabbit, guineapig, and cat, as well as by Treub and Leyver, they have not been verified by microscopic

examinations; consequently other theories have been sought for.

The reflex theory alone explains these various muscular lesions. Its partisans admit that the irritation of the nerves near the joints produce an increase in the trophic influence of the nerve-centers and produce an amyotrophy by a centrifugal route, or a centripetal irritation acts on the nervous centers, not by increasing the trophic influence of these centers, but, on the contrary, by diminishing it; this would be an arrest in the action of the trophic centers by reflex influence.

Now atrophy predominates in the extensor muscles of the joint, and it is to be especially noted on the anterior aspect of the thigh, the posterior aspect of the leg, when an osteomyelitis is situated in the lower limb. It consequently results that the antagonistic members being no longer equal in their action, alone act and produce the faulty attitude of the limb. It is in the lower limb that these faulty positions are by far the most frequent, and many cases of acquired clubfoot during a chronic osteomyelitis have occurred on account of atrophy of a group of muscles.

If the muscular atrophy is not very pronounced, and if the muscle-substance itself is not destroyed by suppuration, an appropriate treatment with electricity and massage may be able to efface the pathologic processes. If, on the contrary, suppuration has been extensive, the muscle may be entirely destroyed, and its only remnant being a thick fibrous band adherent to the skin, must be completely cut through in order to give the limb its former shape.

Chronic osteomyelitis may produce various functional troubles of the nerves. In some cases the nerve is compressed by a cicatrix, or is wounded by the presence of a hyperostosis, which pushes it against a resisting structure, such as the aponeurosis or a bone. Thus at the elbow, the ulnar nerve may be injured by a hyperostosis situated in this position, on account of its passage behind the epitrochlea. At other times the nerves may be wounded by a sequestrum, whose sharp point constantly irritates the coverings of the former, and different symptoms

of varying intensity, according to the gravity of the lesion, are observed in these cases.

In the first place tingling, cramps, and a sensation of heat are first complained of, and then there is hyperesthesia of the skin, which is soon followed by a progressive anesthesia. The muscles which are in the first place benumbed, undergo the commencement of atrophy, and after a certain time, if, failing an operation, the nerves recover their functions, the muscular contractility will first be seen to return, and afterwards the sense of touch and pain; and later still the sense of temperature appears.

If the compression is considerable, the pain is intense and will cover all the region supplied by the nerve; the patient will complain of shooting pains in the first place, and then a numb feeling in the parts, followed by a complete or incomplete motor paralysis; these symptoms may be of short duration only, and the sensibility and contractility soon return.

The symptoms of contusion of the nerves are not sensibly different from those occurring in the former condition; if the contusion has been considerable, the disturbances of sense are first noted, and then graver disorders appear, such as sensory or motor paralysis, due in most likelihood to an intercurrent neuritis. The immediate and consecutive motor disturbances are very variable and are in intensity in direct relation to the amount of damage done to the nerve. They rarely produce an absolute muscular impotency, but occasionally they are the cause of spasms or temporary or permanent contraction.

Now, if an electrical examination of the muscles be made at various times, the following phenomena will be remarked. At the beginning and during the first few days following the nervous lesions, the muscles lose their contractility to the faradic current little by little; at the end of about eighteen or twenty days, the limb no longer reacts to the interrupted current. The reaction occasioned by the galvanic current during the first ten days is a diminution, then an increase and they reach their height at the time when reaction to the faradic current has become *nil*. If the nerve

does not return to its normal condition, the galvanic curve will descend to the normal, and then the reaction will descend little by little until it is no longer present, and when this occurs muscular contraction is lost forever. If, on the contrary, the nerve goes back to its normal condition, the reaction to the faradic current progressively returns.

Besides these functional muscular troubles produced by lesions of the nervous trunks, I must also mention the nutritive troubles, which especially take place in the skin, the hair, the nails and the subcutaneous cellular tissue. The skin may present several conditions; sometimes it is red, smooth and dense and may feel scaly and rough to the touch. The epidermis becomes detached and remains adherent in more or less necrosed patches. Sometimes the layer of papillae situated under the altered skin may be seen, from which results an atonic ulceration which is very difficult to heal.

The hair splits up and falls in many cases, but sometimes it becomes hypertrophied, especially when there is a purulent focus in the neighborhood. The nails become hard, brittle and cracked, blackish in color and rough. As to the cellular tissue, it is sometimes infiltrated, at others indurated.

The nerves may become inflamed when they have been in contact for some time with a purulent focus. The nerve-trunk becomes increased in size, while the vessels which go from its surface and penetrate into its depth are dilated and may even rupture. The nerve loses its glossy aspect and becomes a bloody yellow, while sometimes small ecchymoses may be seen on its surface. It is considerably altered in its anatomic structure, while the nerve bundles are usually dissociated. This dissociation may bring about a degeneration of the nerve-trunks, and by a different mechanism this may produce the same disturbances in immobility and sensibility that have already been mentioned.

The arteries may become ulcerated from contact with the purulent focus. Monod mentions 37 cases of arteritis produced by the contact of pus, and in 6 of these the ulceration occurred during the course of

an osteomyelitis. The same author has also reported an interesting case of a young man of 28 who for 15 years had had an osteomyelitis of the femur. At three different times, on account of ulceration of the popliteal artery and its collaterals, there was serious hemorrhage. The bad general condition of the leg prevented the surgeon from applying a ligature, and amputation of the thigh was performed, but the patient died in the evening.

The other cases of ulcerated arteries occurred at the same spot, and, if you will recollect that this is one of the most common seats of osteomyelitis, and that the presence of the cellular tissue in the popliteal region favors the secretion of pus, you will easily understand that a probe pushed down in this region in order to make an opening to give issue to pus, may strike against the walls of the popliteal artery which is in a condition of ulceration and thus produce a very alarming hemorrhage. Monod explains the process as follows: The artery becomes inflamed by the contact with pus, and this inflammation causes the middle tunic of the vessel to disappear, whose elastic and muscular fibers give place to connective tissue, which becomes intermingled with that of the external tunic. The wall is thus weakened, and if the arterial tension is considerable or even slightly modified in intensity, and if, during a dressing a forceps or a sound hits against the artery with any force, the vessel may rupture, especially when there is a poor general condition, as is usually the case when a patient has been the victim of a prolonged suppuration, and consequently the formation of a clot in the internal membrane, which is irregular and soft, and on the external membrane of protective sheath, due to the proliferation of connective tissue of this tunic, which is inflamed and in contact with pus.

These changes in the arterial structures are frequent during the course of an abscess in chronic osteomyelitis; usually they are not noticed, because they give rise to no symptoms. They are only discovered unexpectedly, as during the introduction of a drain into the infectious focus, or during a resection, and then the surgeon unexpectedly comes down on

an artery, which is destroyed and may rupture at the slightest shock. The inflammation may extend to the veins by a similar mechanism. Cornil and Ranzier admit that a periphlebitis and endophlebitis occur simultaneously. In periphlebitis the *vasa vasorum* become dilated and the leukocytes go out in large numbers among the meshes of the connective tissue, whose fixed cells proliferate. By their passage through the external tunic of the vessel they distend it and favor the formation of small purulent collections, which are really nothing but abscesses. These troubles reach the middle tunic of the vessel and a destruction of the muscular fibers takes place, which are replaced by embryonal cells, and are supplied with many vessels, which with the capillaries of all the three tunics lead to the formation of sinuses, lined with endothelium, and situated between the middle and internal tunics. The latter tunic becomes altered in its turn; its endothelium proliferates and masses of embryonal elements are formed, which are supplied by the capillaries starting off from the neighboring sinuses. These vegetations make the walls rough and produce the precipitation of fibrine, and sometimes a kind of false membrane lines the vessel, without, however, obliterating it, but in the majority of cases a clot obstructs the vein.

This clot varies in length; sometimes it occupies quite a long segment of the vessel and may enter into the capillaries. Its central end is usually thin and pointed, and continually being moved about by the flow from the collateral vessels, and it may be broken off and thus produce a distant embolus. Sometimes the clot may become absorbed, and the caliber of the vessel returns to its normal condition; and the blood circulates normally but, on the contrary, the vessel may become completely blocked up, and become transformed into a fibrous band, in which case we have what is called a plastic phlebitis. This condition is not so serious as a suppurative phlebitis, in which we have an abscess distending the walls of the vessel, which become ulcerated, and the clot is destroyed by suppuration; the debris are carried along through the blood into various viscera, where they form an infarct.

When a patient has a phlebitis, he complains of pain along the entire course of the vein, and the limb becomes heavy and edematous, on account of the interruption of the circulation, which is then effected by the small vessels which become dilated, in order to allow the passage of blood, which can no longer pass through the large veins. Small subcutaneous vessels will soon appear in patches, and produce blisters filled with a reddish or transparent serous fluid. This edema may remain stationary for a certain time, and then little by little disappear, but unfortunately the ultimate recovery of the limb is far from always being obtained, and suppuration occurs. The skin becomes raised up along the course of the vein, and one or several collections of pus are formed. These abscesses ulcerate the integuments, and the pus burrows its way outwards, with or without hemorrhage. Occasionally, the abscess opens into the vein, and, if a resisting clot does not obstruct the canal, the pus mixes with the blood, and pyemia is the result. Although this termination is rather infrequent in the chronic form of osteomyelitis, it will occur, especially when the patient has had a suppurating focus for a long time.

We now come, gentlemen, to the consideration of the general complications of chronic osteomyelitis, and foremost among them we should place the lesions of the kidneys, which occur in the form of nephritides. According to Mouret, it has usually been found that a nephritis may occur during any of the stages of the disease. It often occurs at the beginning of the acute stage, ceases during a certain time, and then reappears as soon as the first relapse has occurred. Verneuil has seen nephritis occur two, three or often more years after the acute symptoms of an osteomyelitis, at the time when there was an elimination of the sequestrum, or when the focus of suppuration was cleaned out. The symptoms produced by a nephritis during an osteomyelitis are to be particularly looked for in the quantity, color, and composition of the urine. In the first place, there is usually a marked decrease in the quantity of urine voided in the twenty-four hours. It may go as low as 700 or even 600 cc., and

this decrease may be explained by the accumulation of the epithelial casts in the tubuli contorti, which prevents the flow of the urine. During the first days the urine is colored a dark red, on account of the presence of more or less large amount of red blood corpuscles, which have transuded with the albumin, and which show that there has occurred a capillary hemorrhage from the vessels of the kidney. After two or three days, this hemorrhage ceases, and the urine becomes clear and limpid. The composition of the urine is extremely changed, and when it is heated or treated by the usual reagents, we usually obtain an abundant precipitate. The quantity of albumin is considerable in the beginning, and lasts for a long time in serious cases, while in lighter ones, and those having a more favorable outcome, it diminishes.

There are always a certain number of bacteria in the urine, either in the form of rods or cocci. We also find granular, colloid, or mucous casts at the same time. They are sometimes covered with epithelial cells, in the center of which will be perceived the microorganisms, after they have been stained by the various processes, such as osmic acid or hematoxylin. Generally speaking, the nephritis of an osteo-periostitis is only temporary, and has a tendency to get well. As it is the product of an infectious agent, it naturally disappears as soon as the organism is free from the cause. There are two ways of eliminating the bacteria; either rapidly, without producing very much damage, or, on the contrary, producing lesions capable in themselves of putting a patient's life in danger. In favorable cases, this complication lasts from eight to fifteen days, while, in serious ones which have a fatal issue, the duration is longer, and the albumin is present up to the last. This nephritis is subject to relapses which are almost impossible to foresee.

Among other complications which may occur during a chronic osteomyelitis, I may mention amyloid degeneration of the liver, which occurs after any prolonged suppuration; septic embolus, which may take place in the lungs; purulent infection, with multiple abscess occurring in the pericardium or the pleura;

but these lesions are infrequent during an acute affection, and are still more so during the chronic period, and consequently I only mention them in passing.

Now, considering the progress of chronic osteomyelitis, I may say that it rarely gets well without medical aid, and when it is left to itself, and even if it does get well, it takes a very long period, perhaps as much as two years, for the slow and progressive elimination of one or several pieces of necrosed bone from the diseased limb; and still more it is necessary that the sequestrum be small, in order to make a passage through a cutaneous opening. Usually the patient is obliged to go to the surgeon, who, if he operates properly by performing a large resection or amputation of the limb, will place the patient in all the necessary conditions for avoiding a relapse. Perfect antisepsis is necessary, and the infected region should be very carefully cleaned out, but in spite of that, although the surgeon has placed the patient in the best conditions possible for a favorable result, it may happen that the recurrence of the trouble occurs in some other bone, for the simple reason that the organism is not free from the microbes producing an osteomyelitis.

The duration of chronic osteomyelitis is very variable, and in the beginning in some cases, on account of the general appearance the condition may be considered as not very serious. Many osteomyelites which have been considered chronic from the beginning, and which have commenced without fever, characterized by the elimination of sequestra from time to time, have only had a fatal result 15 or even 25 years later. The age of the subject and the duration of the trouble does not prevent him from death at a distant period.

Chronic osteomyelitis may end by complete recovery or by death. In the first case the return to health may be either complete or simply relative, and the limb may recover all its functions. This result is, however, infrequent, and, in order that this shall occur, the organism must have been only very lightly infected, and the operation performed in the diseased

parts must also have been extremely free. In a relative recovery the limb may still be good to a certain extent, but its functions are not sufficiently carried out. Atrophy of the muscles will cause a weakening, and it is always either shortened or lengthened. The joint is in a state of ankylosis, and from this a bad position of the limb will be produced.

A large number of the patients with chronic osteomyelitis die, and death may occur in several ways. Usually the fatal cases are those which have waited too long before seeking surgical treatment, or else it is the fault of the attending physician who is too conservative and who hopes to finally pull the patient through. Little by little the strength of a patient will decrease, and his organism will struggle in vain against the constant suppuration which is going on. They are finally obliged to remain in bed, hectic fever appears, and the patient looks like a person in the last stages of tuberculosis, and, if a full history of the case is not obtained, one is very liable to be led into error.

At other times the ulcerated arteries, or the contact of a purulent focus, or the introduction of a drainage tube will produce the fatal outcome, on account of the serious hemorrhage which will take place. A number of troubles have resulted from renal insufficiency, because the toxic products are not properly eliminated, and the patient dies from a toxemia. Albumin occurs, and later on there is uremia. Another fatal issue is that by metastatic abscess, which may become localized in the various viscera, such as the liver or the kidneys.

Regarding the diagnosis, I would say that it presents considerable difficulty. Generally the patients who ask for help, will say that they have been smitten by their disease when quite young, and that ever since they have been more or less troubled by the condition, although some will not be able to give any data as to the primary disease. In the latter case one would be liable to attribute the trouble to every other cause excepting the true one. Very often the only remnant of the old trouble will be a small cicatrix that will have become covered by a growth of hair, which has occurred since they have become

adults. Then, afterwards, this cicatrix will no longer be in exactly the same position as was the primary focus, and it will be found higher up, and, if it be incised, nothing but normal tissue is found. The affection is disguised by symptoms which take on a considerable importance. The patient often will have considerable fever and may be found in a state of torpor from which it will be difficult to rouse him, and under such circumstances it is easy to mistake the condition for typhoid. But, if the patient be very carefully examined, if we determine the actual commencement of the disease, if we will notice that this febrile condition, which is extremely marked, has not been preceded by constipation, diarrhea, or any other symptoms, as is the case in typhoid, and if there is a tumefaction in the joint or in its neighborhood, we will be able to avoid making a mistake. And still more, if the limb of the patient be grasped and movements given it, it will be noticed that they will be perfectly free in typhoid fever, and no pain will be complained of by the patient, while in osteomyelitis the pain is extremely severe, and the forced movements that are given the limb or the joint, cause him to cry out. The disease may also be rendered less apparent if the patient has an infectious disease which has started up a latent osteomyelitis. In other cases we have an infectious disease such as smallpox, typhoid, gonorrhea or syphilis, and a fresh attack of the former affection will occur. Others, after a traumatism or gunshot wound, will certainly lay greater stress on the details of the accident, which they consider as the principal cause of their trouble, when in reality it is only a secondary one.

The pains in the joints may lead one to believe that there is rheumatism, but a detailed examination carried over all the bones, and pressure made with the hand on the principal regions in which osteomyelitis develops, will lead to the discovery of the true disease. For that matter, a negative result in medical treatment, particularly with the exhibition of salicylate of sodium or antipyrine, is a very important indication, as these medicines are extremely efficacious in rheumatism, and only slightly modify the

condition of affairs in osteomyelitis, and only have a calmative effect over the pain and the temperature in the latter disease. Nearly always a careful and detailed examination of the region will show that the pains are more intense and follow the articular surface than in the synovial membrane itself, and consequently shows that the trouble is either in the bone or in its juxtapophyseal region.

Regarding the differential diagnosis of osteomyelitis with tuberculosis, I would point out that in the latter disease the affection is insidious, and the pain is always the first symptom complained of by the patient. This pain, contrary to that produced by an osteomyelitis, is only trifling, and not durable for any length of time, and never presents the intensity of those met with in osteomyelitis. Then in tuberculosis, tumefaction develops over some part of the bone, and after a certain time it becomes softened, and fluctuation may be detected in its center. The abscess which follows may evolve in the spot, or, on the contrary, it may burrow through the tissues in such a way that it occasionally opens at a very distant part from the origin of the disease. Its progress, which is different in each region, depends on the position of the aponeurotic layers as well as the vascular and nervous tracks, which serve as conductors along which the pus travels.

A tuberculous abscess is contained in a pocket; the contents is a serous and badly mixed pus, in which cheesy lumps and occasionally very small sequestra in the form of lamellæ or particles of bone are found. Sometimes the contact of small vessels with the purulent pocket and their consecutive ulceration, may change the color of the pus, which becomes brownish or a very dark purple. The size of these abscesses is very variable, and is largely dependent on the length of time in which the disease has been present, as well as its location, and the type of the tuberculosis. These abscesses may sometimes only contain fungosities, and all trace of pus is lacking. These fungosities are soft, whitish in aspect and are easily removed by the sharp curet. They are most always found on the subcutaneous cellular fascia, as well as

in the intermuscular tissues. They perforate the periosteum and invade the tissues of the bone, and thus form a new fungous pocket, which may reach very large dimensions. The skin becomes very much distended by these abscesses, and sometimes one can evacuate liters of pus; after a variable lapse of time the skin will end by becoming thin over a certain point, and after taking on a highly reddish color, it becomes perforated, and the pus makes its exit.

If the abscess has not been well irrigated and disinfected the suppuration will continue, although it may not increase. The cutaneous opening does not close up, but becomes filled with fungous material, and from time to time some pus escapes, as well as a small sequestrum, although the latter does not occur often. If a sound is introduced into the fistula, and, if we are dealing with a sessile abscess, the instrument will come down on a denuded bony surface, which will be recognized by its characteristic grating feel. Sometimes the sound will come against a hard, irregular surface; while at others we will be able to push it into a soft rarified bony tissue, and the lamellæ of the bone can be broken easily. This latter sign, which is called fine crepititation, is due to the tearing of the bone lamellæ by the probe, and has always been regarded as pathognomonic of caries.

Tuberculous lesions of the bones are not often accompanied by a rise in temperature, except when the disease is present in some other viscera. When there is a hyperostosis, which is infrequent, the lesion will occupy the entire bone. Now one way in which we can distinguish tuberculous osteitis from a chronic osteomyelitis, is the more considerable length of time that the latter has been present, that it has presented a peculiar condition of exacerbation, which has especially manifested itself during the period of growth; the sequestra are far more extensive, and the look of the pus is not the same. We do not have fungous material as in tuberculosis, and the general condition of the patient is far better for a long time in chronic osteomyelitis, and also in this disease one will not be able to elicit any hereditary history from the patient. The diagnosis is more difficult when tuberculosis has

occurred in a patient who is still growing; often the lesions of tuberculosis and osteomyelitis evolute together, and in this case it is only by the aid of the microscope that one will be able to decide with which disease he is dealing.

Syphilitic osteitis has very distinct characteristics, and its diagnosis is consequently far easier. The bones most usually attacked by syphilis are those of the head and the face, and we should always be careful to look at the head of the patient for syphilitic lesions when in presence of a case which presents certain difficulties. The tibia is, of the long bones, the one the most usually attacked by syphilis, and in this case we find its sharp border pointing outwards, and the patient will complain of osteoscopic pains, which usually coincide with the existence of a chancre whose traces will usually be found on the patient. A means which will permit to settle the diagnosis is the mercurial treatment. The exhibition of mercury protiodid has a very potent influence on the syphilitic diathesis. The diagnosis is more difficult when dealing with gummas, and at the same time the patient may present other lesions which are not due to the specific diathesis; such are, necrosis, suppuration due to sequestrums, sclerosis and hyperostosis, which are in no way controled by potassium iodid and mercury. In this case, gentlemen, we must remove all doubt; the sequestrums have as characters to be cut out cleanly and are of a golden yellow color, and when once these sequestrums are removed, mercurial treatment will act wonders.

If a careful inquiry into the antecedents of the patient has been made, and if we attentively examine the diseased parts, we will not usually mistake a lesion due to chronic osteomyelitis with a tubercular or syphilitic osteitis. The joint lesions in osteomyelitis are usually those which are more likely to lead to an erroneous conclusion, because in the beginning of the disease they closely resemble hydarthrosis and, later on in the affection, a white swelling. A symptom which will permit us to avoid a mistake with the first mentioned disease, is the appearance of pain, which usually is very pronounced, the con-

trary to what occurs in hydrarthrosis, which is painless, and which usually manifests itself by a disorder in the movements of the joints and functional impotency. Contrary to what occurs in hydrarthrosis the tumefaction will usually be found in the periarticular tissues, and its maximum is not found in the synovial culs-de-sac. One can easily feel the bony projections in an osteomyelitic osteoarthritis. Later on the atrophy of the quadriceps and the abnormal attitude of the limb, such as subdislocation of the tibia, etc., will give the clue to a diagnosis, because these joint troubles are peculiar to chronic osteomyelitis. When the pathologic process is very extensive, so much so that the patient has been obliged to keep absolutely quiet, and the joint is riddled with fistulas, giving issue to pus, the question of tuberculosis presents itself. The skin, as in tuberculous arthritis, is a violet color and ulcerated, while the limb has a yellowish color, and the patient is incapable of moving it in the slightest degree.

The fact that the lesion has begun in the bone and has secondarily attacked the joint would at once lead to a diagnosis of an osteoarthritis due to a chronic osteomyelitis, because in tubercular arthritis the lesion commences in most cases in the synovial membrane, which is in a fungous condition, and gives a pasty feel to the joint. The aspect of the purulent foci is not the same in the two diseases; in white swelling the pus which comes away contains fungous masses or cheesy concretions and is often mixed with blood, while in osteomyelitis it is a laudable pus. The cultures from the former will show the presence of the bacillus of tuberculosis, while in osteomyelitis the infectious agent of the disease is grown, which is usually the streptococcus.

The prognosis of these cases should always be guarded as relapses are frequent. It will be all the more favorable when an operation has been performed soon after the first attack, or, if necrosed tissue has been removed, in which case the patient will be less likely to have a new outbreak. There are cases in which surgical interference is prevented on account of the bad general condition of the patient due to

autointoxication. As I have said, some of these patients die from the mere fact of a prolonged suppuration, while there are others who die because their kidneys no longer eliminate the toxic products. Others die from epithelial transformation of the primary focus of osteomyelitis, and, although this end is very infrequent, it should be recalled to mind when giving a prognosis.

The manner in which one may suppose that a malignant change is going on is by the transformation of the granulations in the neighborhood of the fistula into epitheliomatous granulations. The secretion in the latter case will be extremely fetid, in spite of irrigation and antisepsis. The sequestra that are removed from the focus are often as black as coal and give forth a purulent odor. Epithelioma has a tendency to extend into the focus instead of outwardly, and in this case the most radical operation is amputation of the limb as far up as possible. If this malignant transformation has already given rise to infiltration of the glands, they should also be removed.

Regarding the treatment of chronic osteomyelitis, it naturally varies according to the length of time the patient has been afflicted, as well as to his age and general condition. If we are dealing with a subject who has had one or two relapses of osteomyelitis, incisions into the periosteum with drainage will probably not be sufficient, and a more radical operation is necessary. A radical operation, even if it will not entirely cure, will at least prevent another relapse.

A long incision through the skin over the focus, should be practised, the bone exposed by the free use of the chisel and hammer, and the necrosed bony tissue and sequestra must be carefully removed. It often happens that the cause which made the disease continue will be discovered, which is often a small purulent focus hidden in the bone itself near one of the epiphyses. If this condition of affairs is found, the focus should be thoroughly disinfected and packed with oxyiodid of bismuth gauze or xeroform gauze, in order to secure good drainage. An excellent method is to trephine both ends of the bone and pass a drain

through its entire length, and this should only be removed when all trace of secretion has stopped.

It often happens that the bone will be destroyed to a considerable extent, as well as around its entire circumference, in which case the necrosed parts are to be cut out, which, if left in place, would certainly compromise the ultimate result of the operation. The segments of the bone are united by a silver suture, and, after an antiseptic dressing has been applied, the limb is placed in a plaster dressing. After a certain time the bone will become consolidated, but it will be shortened and all the more so according to the size of the piece of bone removed. In order to prevent this shortening, decalcified bone has been placed between the two fragments, or bone grafts may be made. The results that have been obtained are excellent, and this method may be employed in young and adult subjects who are not too much undermined by the disease.

Now, when dealing with cases in which too much damage has been wrought, so that definitive cure cannot be brought about by a conservative operation, we must sacrifice the limb, but on this point I would say that surgeons are not all of the same idea; some advise amputation, and others, disarticulation. Now, regarding these two operations, I believe it is better to choose between them when considering a given case, but, as we are obliged to explain to the patient the nature of the operation, one must always have it understood beforehand that he will do the best he can for him, and he must leave it to the surgeon to use his judgment.

When damage has been considerable, amputate, and do this high up and as far away from the primary focus of the disease as is possible. When dealing with a weak and septic patient, I should advise always to choose amputation, because less blood is lost, and at the same time it is usually quicker to execute.

It is not the same when dealing with an osteomyelitis which has invaded the upper epiphysis of the limb and has extended deeply into it. In this case I would advise disarticulation, in order to prevent a relapse.

As to the localizations of osteomyelitis in the joints, a resection gives very excellent results and should be performed in this class of patients.

Like all other diseases in the domain of surgery, the general condition of the patient must be attended to by medical treatment, and, on account of the infectious condition and the debility of these patients, internal antisepsis and the free use of properly selected tonics, such as iron, kola, etc., are indicated.

As soon as is practical, the patient should be allowed to take the fresh air and, if possible, when well enough, should be sent to the seashore for two or three months.